EXECUTIVE SUMMARY

Math and Science Academy

Development Year Report

October 2001

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The work reported herein was supported by the University of California Office of the President (UCOP) with funding to the National Center for Research on Evaluation, Standards, and Student Testing (CRESST).

The findings and opinions expressed in this report are those of the authors and do not reflect the positions or policies of the University of California Office of the President.

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This evaluation report summarizes the implementation and impact of the Math and Science Academy (MSA), an initiative of the Northern New Mexico Council on Excellence in Education. Below, we present an overview of the project, describe the methodology used to conduct the evaluation, discuss findings from the development year of the program and conclude with recommendations and refinements for future years of MSA.

Background: Project Goals and Objectives

The Northern New Mexico Council on Excellence in Education (NNMCEE) developed the Math and Science Academy, with support from local school districts (Chama, Española, and Mora), the Northern Network for Rural Education, the University of California and the Department of Energy's Los Alamos National Laboratory (LANL). In the initial year of implementation, MSA's goal was to significantly improve math and science education, as part of a larger systematic change initiative to improve the education for the students of Northern New Mexico. The project aimed to provide middle school teachers and their students the opportunity to work with exemplary science and math mentors and gain content knowledge, experience and expertise by working collaboratively with a cadre of other committed schools and teachers. The MSA project addressed multiple purposes, including providing teachers with access to rich professional development sessions to increase content and pedagogical knowledge; stimulating teachers to consider how well their instruction is preparing students for high school academics and how it can better do so; providing tools and conceptual structures for content area instruction that can be

integrated directly into classroom teaching and learning practices; and providing students with opportunities to engage in high quality science, math, social studies and language arts learning experiences. Initially, MSA targeted middle school students, in an effort to stem the high drop out rate in 9th grade (8.1% in 1997, higher for Latino males), and to allow teachers adequate time to help their students develop the knowledge, interest and enthusiasm to enroll in challenging high school classes. Finally, the first year of the project aimed to improve the overall quality of education in middle schools in Northern New Mexico, by providing opportunities for all students to engage in high quality learning experiences taught by qualified, knowledgeable instructors.

Project Overview

The long-term goals of the project are ambitious and far reaching-student test scores and teacher competency surveys reveal a tremendous need for improving student achievement and teacher preparation in Northern New Mexico. Simultaneously, LANL has a need for hiring qualified employees to work in a wide variety of lab positions (scientific, technical and administrative) and views Northern New Mexico as a valuable and logical source for developing and cultivating a workforce and providing employment opportunities to the citizens of the region.

MSA was introduced in the summer of 2000. Teachers and mentors spent two weeks involved in intense professional development, discussing and developing curricula and instructional methods, and planning for the 2000-2001 academic year. The project was led by two mentor teachers, selected for the program based on their experience developing curriculum, professional development expertise, knowledge of standards and reform initiative, proficiency in the use of technology in education and experience working with middle school students.

MSA's development year has focused on three middle schools located in Northern New Mexico. These sites were selected for project participation based on a competitive application process. At each site a team of teachers (4 teachers from each site, 12 total teachers) worked with the two mentors during the school year to develop instruction strategies and implement curricula to support and strengthen student learning and achievement in math, science, social studies and language arts. Throughout the school year, mentors and teachers collaborated with each other, participated in on-going professional development sessions, and worked to develop curricula and teaching methods to support on-going efforts to improve the quality of math, science, language arts and social studies education at MSA schools. Project members also collaborated

with school administrators and community members to inform them about the project and its' goals.

Evaluation and Design Issues

The UCLA/CRESST evaluation study of MSA was designed to describe how the program was implemented, to assess its effects and to generate recommendations for the improvement and enhancement of the program. Four main questions guided the evaluation:

- How was the program implemented?
- What were program effects on mentors, teachers, students and parents?
- How and in what ways did district administrative policies impact program implementation?
- How can the program be enhanced or improved?

The evaluation employed a multi-method approach to understand and assess program implementation and effects. Surveys, interviews, focus groups, program documents and observation of program activities were used as information sources on program implementation and impact. Regular communication (e-mail and telephone) with project administrators and participants served as an additional source of project data.

Our approach to this evaluation was formative, that is, by systematically conferring with project participants throughout the year, our goal was to provide important information to project members regarding project successes and challenges. This report synthesizes results and observations from the initial year of the project and provides recommendations for strengthening MSA and increasing its impact on teachers and students during subsequent years of the project. The first year evaluation was designed to help project leaders further refine the programs' theory of action, to more clearly articulate a research design for subsequent years and to provide a better understanding of evaluation needs for additional years of the project.

Project Findings: Year 1

In this section we present a summary of findings from the project based on data collected during the development year of MSA. Results are organized around our four

research questions. Specifically, we report findings based on project implementation, impact and recommendations for future years of MSA.

How Was the Program Implemented?

The notion to establish a math and science academy in northern New Mexico emerged as part NNMCEE strategic planning sessions held in February 1999. Participants represented leadership in northern New Mexico - school district superintendents, two-year college presidents, business leaders, school board members, school principals, teachers, parents, project directors, staff members from Los Alamos National Laboratory and students. NNMCEE established four goals at the February 1999 strategic session, the fourth of which became the establishment of a math and science academy. Program objectives, funding, educational goals and a direction for the academy was developed through a series of consensus building activities that included review of data about schools in northern New Mexico and reviewing research on similar initiatives throughout the country. Thus, the 1999-2000 school year became the year of research and design for the Math and Science, while the 2000-2001 school year was a year of development and testing for the Academy.

As a result of research and collaboration, the MSA model incorporated a number of different features from various reform efforts (including an apprenticeship model, standards-based instruction, technological support and innovation); these program policies and philosophies were combined and refined to create a general "theory of action" for a 5-year project. Central to the program's vision was the notion of thematic or interdisciplinary instruction (defined in this project as the study of an essential question, problem or situation through the multiple lenses of mathematics, science, language arts and social studies) as a vehicle by which to improve instruction and student learning. The implied goal was that through the process of developing and using multidisciplinary units, teams of teachers would collaborate with each other and subsequently improve their instruction and increase student learning and performance. Work carried out during the development year has provided a great deal more direction, specificity, and clarity to MSA as a model for teacher professional development.

The project was initiated during the summer of 2000. MSA teachers and project mentors devoted two weeks (10 days) of time to intense professional development. Teachers participated in a series of sessions to introduce and familiarize them with new instructional approaches, to reinforce the use of standards based instruction and to

discuss current research on learning and instruction. Specifically, at the Summer Institute mentors and teachers worked to: 1) establish the ground work for on-going collaboration between teams of teachers at each site and across sites; 2) develop a thematic unit; and 3) study and review recent developments in the area of learning and instruction, specifically assessment and standards-based instruction. These 2000-2001 program goals were then revisited and built upon throughout the academic year as MSA mentors continued their on-going collaboration and coaching of project teachers.

Throughout the school year, mentor teachers visited each school once each week. During these visits, mentors observed MSA teachers in their classrooms, provided demonstration lessons when requested (primarily in math and science classrooms), substituted to allow teachers to visit other classrooms, and worked with students in small groups to answer questions and provide additional assistance and instruction. At the conclusion of these site visits, mentors met with the MSA team for 2 hours to debrief or discuss the lessons they observed, to discuss specific topics of study or teaching approaches and to provide general support for the teachers and the project. Mentors also gave presentations to school boards and to personnel at district offices to familiarize them with MSA and its objectives.

Over the course of the school year, MSA teachers met during their common planning time or after school to discuss instructional plans, student work and student performance on a weekly basis. Additionally, teachers from all sites met four times during the school year for Saturday sessions to further extend their understandings of new ideas presented in the project and to collaborate with teachers at the other MSA sites. Mentors, teachers and students also gave MSA evening presentations for parents and community members. A final 3-day work session for mentors and teachers was culminating event of the development year of MSA.

Overall, students, teachers, parents, administrators and mentors viewed the MSA project and its implementation as successful. As the school year progressed, each of the sites experienced successes and challenges as the project was implemented. More specific information and a fuller discussion of these MSA successes and challenges will be presented in the next section.

What Were Project Effects on Participants?

Effects on MSA teachers. Surveys results, observations and interviews of the twelve MSA teachers indicate that the project positively influenced teachers in a

number of ways. Specifically, MSA had an impact on teacher's: 1) collaboration, planning and articulation processes; 2) knowledge and familiarity of current research on teaching and learning, including grouping practices; 3) types of assignments, activities and assessments used; and 4) understanding of content area standards and standards-based instruction. These findings represent critical contributions to MSA's goal of strengthening teaching and learning. Teacher buy-in and implementation of project goals and objectives were observed and reported in varying degrees at individual sites and for individual teachers in the project. In general however, teachers were enthusiastic, interested, and positive about MSA and its impact on their instructional practices and understandings of standards-based teaching and assessment.

At the classroom level, MSA impact was observed in a number of dimensions of instruction. In science classrooms, MSA students were involved with investigations and presentations of their findings; in math classrooms, MSA students solved problems in group settings and developed architectural plans involving mathematical computations; in social studies, MSA students learned about the history of their community and took "field trips" to visit local sites of interest that tied into their family histories; and in language arts, MSA students read and evaluated texts critically and gave formal presentations of their ideas, and were then evaluated using a standards-based rubric. These activities represent shifts away from more traditional teacher-led, text-driven approaches to learning and instruction, to more standards-based, theory and research driven learning and instructional goals and objectives espoused by MSA. The findings are positive indications of the impact MSA is having on teachers and their teaching practices.

Effects on MSA students. Evidence, in the form of classroom observations and interviews suggest that MSA students learned more content and in a different manner than did their non-MSA peers. Based on classroom observations and reports from teachers, mentors and administrators, MSA students developed clear understandings of standards and benchmarks, had opportunities to work collaboratively with their peers, and received on-going support and assistance from their MSA teachers, even when more rigid standards for performance and behavior were implemented in their classrooms. Data from a MSA mentor created student survey indicate that students' overall affect towards math, science, and school was moderately positive. No comparison affective survey data (for non-MSA students) are available at the writing of this report.

Results from standardized achievement tests (CTBS Terra Nova) reveal no significant increase in scores or only a minimal increase of students' test scores in all subject areas. However, given that MSA is a new project, it is reasonable to expect minimal improvements in standardized achievement test scores. Additionally, standardized tests have come under criticism for not being sensitive to instructional changes and for not being aligned to MSA teaching and the standards to which teachers and schools are being held accountable. Finally, quality implementation of MSA project goals requires time for teachers to learn new techniques and incorporate them effectively into the teaching and learning process.

Effects on MSA parents. Survey results from MSA parents indicated moderate improvements in their children's performance in math and science learning. We also recorded informal conversations between MSA parents and teachers, and used attendance at MSA school-sponsored events as an indication of parent understanding and awareness of MSA. At one MSA site, typical parent turnout for school functions was around 25% of the population. This year, however, for MSA sponsored evening events—MSA Open House, Star Gazing Night, and Science Night- approximately 75% of the parents attended. The increase in parent attendance at school events and contact with MSA teachers is further evidence of parent interest and support of MSA.

At all sites MSA teachers dedicated more time to meeting and conferencing with parents during this first year of the project. Teachers reported meeting with parents in record numbers. Further, many teachers cited "increased parent contact due to MSA program" as a major program accomplishment during the first year of the program.

Informal conversations between parents and teachers, in school hallways and at school events, included many positive comments about MSA and its impact on students. One parent commented to an MSA mentor:

> You know, I'm so glad you are here this year doing work with MSA. It's really making a difference for my child. He is doing his homework and really likes what's happening in science. There's so much more working together and you know, he's so shy. But in these science groups he really has a chance to show what he knows.

Principals' and administrators' views of MSA effects. Principals and district administrators (Superintendents and Assistant Superintendent) were interviewed on several occasions about their knowledge of MSA and their perceptions of project impact on teachers and students. Overall, principals were impressed with MSA, with teachers'

commitment to the project and with the kinds of instruction in which they observed students engaged. Principals further noted a strong focus on content area standards in MSA classrooms, and a willingness of MSA staff to employ a problem-solving mentality when they encountered challenging situations involving students and district procedures. District administrators were likewise impressed with MSA, and viewed the project as a positive experience for teachers and students in their districts.

How did District Administrative Policies Impact MSA?

Data in this section of the report are generated from document reviews and interviews with MSA participants. Before the introduction of MSA at each of the three sites, district administrators signed a Memorandum of Agreement (MOA). These agreements outlined the roles and responsibilities districts were required to comply with as a commitment to the project. Overall, because this was a voluntary project, that is, districts applied for the privilege to participate in MSA, most district policies regarding MSA were supportive and positive in regards to MSA program goals and objectives.

Project mentors did struggle with a number of issues relative to these MOA's and various district policies at different times throughout the school year. First, access to technology, in particular access to the wiring necessary to set-up and maintain Internet access, proved to problematic for MSA schools. This was a not a district policy problem per se, but rather reflects the significant and continuing challenges these districts face (and ones that will continue to have an impact on MSA) because of their geographical circumstances and the status of the physical facilities at the sites. Inadequate electrical systems and outdated classroom facilities have prevented installation of the systems, and other demands on the districts have taken priority over providing or updating services to MSA classrooms.

Second, adherence to the schedule requests in the MOA, specifically for a common planning time for teachers, and release time for meetings and from other school level responsibilities, proved to be problematic for districts. Again, this was not a specific "policy" that created difficulties for MSA members, but rather site level demands that created challenges to the MSA project.

Finally, district policies relative to the payment of stipends for travel and per diem caused some frustration for MSA teachers. Mentors also were drawn into the fray and had to spend valuable time in helping to solve these problems. Delays in processing of

stipends, confusion regarding the use of district vehicles for travel to MSA professional development sessions and which activities specifically constituted MSA events were some of the administrative obstacles faced by MSA members.

Conclusions and Refinements for the Future of MSA

In this section, we present, in summary form, the accomplishments and challenges faced by the Math and Science Academy during their development year. One of the primary accomplishments of MSA was the establishment of teacher cadres with a strong commitment to improving student learning at individual school sites. Accompanying these groups was the development of on-going professional discourse around issues of learning and instruction. At the classroom level, we saw the beginnings of reform in teaching practices, with a definite move towards standards-based instruction and the use of instructional strategies and assessments in line with current research and theories of teaching and learning. As a result of collaboration with their colleagues, more rigorous standards and expectations for student performance, learning and behavior were articulated in MSA classrooms. A clearer sense of how and in what ways to best support, encourage and facilitate on-going professional development to project teachers emerged during this development year. Administrators expressed moderate levels of support for the project and its objectives. Parents were generally supportive and enthusiastic about project work, in spite of more rigorous standards for their children's performance and behavior. Finally, a better-defined theory of action or model for MSA evolved during the course of the year.

Some of the obstacles or barriers to success encountered by MSA members during this first year of the project were logistical. The lack of common planning time, or planning time being usurped for other purposes (such as parent conferences and other school commitments) made it difficult for MSA teachers to meet and collaborate during regular school hours. At one site, lack of coordination of student schedules or adherence to the "family plan" by administrators lessened MSA impact on student learning and achievement. Another logistical concern was the perception of "entitlement" and special privileges being granted to MSA members from non-MSA staff created difficulties for MSA members and impacted teachers abilities to implement the program more fully. Second, geography, both within the school sites (geographically dispersed classrooms diminished the possibility of team teaching), and between the schools (long distance between the sites), making travel time-consuming for mentors and teachers, was another obstacle encountered by project members. In addition, while

administrators were generally supportive of MSA and its objectives, support was at times uneven. Lip service was paid to MSA goals, but at times there was insufficient "barrier removal" to allow MSA to grow and flourish. Simultaneously, schools faced multiple agendas for projects, rather than an exclusive, concentrated focus on MSA. Early in the project, there were conflicts regarding technology, stipends and transportation issues. The loss of an MSA mentor mid-stream in the project created a hole in leadership and caused an excessive workload for the remaining mentor. Some skepticism on part of participants as to the necessity and importance of on-going professional development, with initial reluctance to buy-in to MSA on the part of some teachers, was also apparent. Finally, community demands for traditional teaching, learning and assessments limited to a certain degree the extent to which teachers could implement wide-scale changes in their teaching and learning practices.

Perhaps the conclusion to this story is the MSA model for professional development has been refined and teachers are very positive about the project. Ten of the 12 original MSA teachers will continue with the project for the 2001-2002 school year (one teacher is returning to graduate school, and the second teacher moved to different content area and grade level). Mentors are beginning to see changes in teaching practices that may have an impact on future student achievement, when the new practices are implemented consistently (and with more attention to the quality of instruction) over the course of the year.

Obvious also is a clear need for measures that are more sensitive to project goals, and methods for more systematic assessment of growth in student knowledge and understandings. Alignment of project goals and objectives with measures that record and analyze the impact of various instructional strategies is critical to project success.

Recommendations

The recommendations that follow are organized around four central themes, topics that emerged as important areas of focus and concern in the three MSA school districts. At the writing of this report, and an indication of the project's interest in polishing and refining the program to the greatest extent possible, many of these recommendations have already been implemented or are in the process of being implemented.

Professional Development

1. Continue to clarify the instructional principles guiding classroom coaching and mentoring. More systematically and thoroughly define model practices and consider how these intersect with the areas in which teachers want to refine their practices. As a step towards addressing this need, teachers and mentors have already developed an observation protocol to guide classroom observations and provide a common focus around which to provide instructional support and refinement.
2. Systematically phase in various reform elements, such as assessment strategies, cooperative learning approaches, and the like. Attempting to deal simultaneously with all elements of the project can be overwhelming for teachers.
3. Continue to refine cross-curricular teaching and learning opportunities. Continue to incorporate units that lend themselves to a particular unit of study, and work to build interdisciplinary curriculum. Remember that it is not necessary to involve all four content areas (math, science, language arts, and social studies) simultaneously in a multidisciplinary unit.
4. Encourage teachers to visit classrooms more regularly with a specific purpose. Build observation time into the MSA teachers' schedules.
5. Provide more demonstration lessons to all teachers and/or include language arts and social studies mentors or specialists in the project.

Administrative Support and Policy

1. Invite principals, counselors, and district administrators to attend MSA meetings on a regular basis. Provide overview of project accomplishments and challenges to further strengthen program support and commitment to the project.
2. To the greatest extent possible, encourage districts and schools to honor teachers' time commitments to MSA by avoiding scheduling conflicts. This requires an increased level of communication and flexibility on the part of all participants with regard to MSA and its objectives.
3. Resolve the issue of transportation and stipends early in the school year to avoid conflicts and distrust of project administrators.

Logistics

1. Adhere to stipend and reimbursement schedule.
2. Consider how the project coordinator can more effectively work with districts, as a conduit of information between project members and school administration and as a means to resolve administrative and/or logistical issues.
3. Help schools to procure access to technology early in the school year, so that teachers and classrooms can correspond easily and share information more rapidly.

4. Consider how mentors can spend more time at each site, to focus more intensely on individual teachers and their practices.

Evaluation

1. Continue to support outside evaluation of the project to provide unbiased documentation of project accomplishments and pitfalls.
2. Develop a process for systematic data collection, at the classroom level and at the school level.
3. Work to assure that districts and schools honor their commitment to provide student level data. Consider whether districts/schools need additional technical assistance in this arena to more effectively understand project impact.
4. Investigate systems to help schools use data more effectively in making instructional and programmatic level decisions, and help schools to access assessment data that is sensitive to project goals and the standards being taught.

MSA has been refined from its original integrated curriculum model, to one that focuses on high-quality, on-going professional development around meaningful problems as a means to increase student learning and achievement. Future years of the project are promising.